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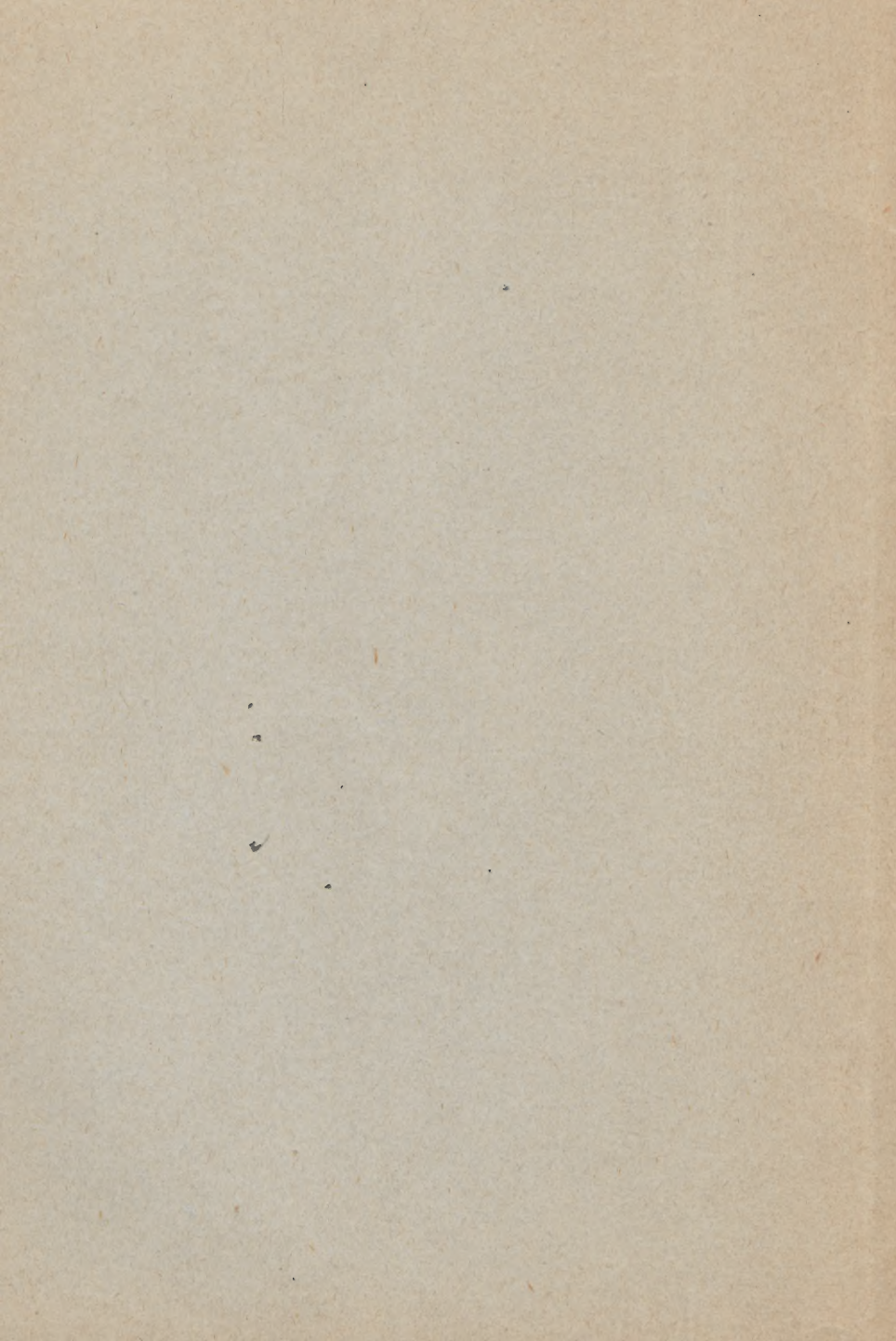
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SANITATION
IN
STREET PAVEMENT.

—MARCY.





Sanitation in Street Pavement.

Read in the Section on State Medicine at the Forty-sixth Annual Meeting of the American Medical Association, held at Baltimore, Md., May 7-10, 1895.

BY
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SANITATION IN STREET PAVEMENT.

One of the most interesting problems of modern sanitation is found in the making and maintaining of the roadbed in the streets of all our larger cities. The dangers therefrom consist chiefly in the atmospheric contamination induced by the great variety of material which necessarily collects upon the roadway and is usually denominated as dust. This, when it is wet, is generally considered as mud, but is better stigmatized by the use of the English acceptance of the word "nasty." When dry, as dust, the atmospheric currents disseminate it in all directions. This the passers-by must often inhale and, by any means yet known, it can not be excluded from the neighboring houses. In great measure, dust is the bane of the housekeeper in urban surroundings. In character it is composite, consisting chiefly of the pulverized material from the surface of the roadbed, mixed with animal excreta, incident to ordinary travel. Under favorable conditions of heat, moisture, etc., these furnish the media for the development and dissemination of disease germs. Infective bacteria are almost never absent from street dust, and they often find an easy entrance into the human economy by means of respiration. So long ago as 1883, I cultivated various forms of bacteria taken from excavations at different depths beneath the best streets in the city of Boston, a noteworthy illustration of which, published at the time, was taken from Beacon Street, opposite the Public Garden, a considerable distance beneath the surface.

Dr. Sternberg, the present Surgeon-General of the United States Army, was one of the first scientists to

call attention to these dangers, and after reporting the results of his investigations upon the filth of cities, as dangerous in large degree, because of septic organisms, wrote: "It must be remembered that the gutter mud of to-day, with its deadly septic organisms, is the dust of to-morrow, which, in respiration, is deposited upon the mucous membrane of the respiratory passages of those who breathe the air loaded with it."

In a circular just issued by the State Board of Health of Massachusetts, indorsed and circulated by the Boston Board of Health, emphasis is made upon the danger arising from the dissemination of the bacilli of tuberculosis. I quote briefly: "Consumption is the most destructive disease of New England; the number of persons dying annually from this cause in Massachusetts alone, amounting to nearly six thousand. The disease is infectious. The chief danger exists in the expectoration of the sick; and if this expectoration is destroyed, little danger is to be feared. Consumptives should be instructed not to spit in open places, "nor in the streets." Remember, the sputa must never be allowed to dry. One of the most common forms of the dissemination of consumption is by the respiration of street dust, never free from infectious material."

Dr. George Baird, discussing the subject of "Sanitation in Street Paving," writes as follows: "Should sanitarians be consulted by municipal authorities in reference to the material used for street paving, and the manner of laying it so as best to protect the lives and health of the citizens?" To this question there should be only an affirmative answer. The macadam road, the cobble pavement, the wood pavement in its various forms, and the granite pavement have all been found more or less objectionable from a sanitary standpoint. The macadam, with its rapidly worn surface and its clouds of dust, carrying disease germs in them; the cobble pavement, with its noise and innumerable pockets, furnishing lodg-

ing places for decaying animal and vegetable matter; the wooden pavement, decaying in a few years, and absorbing urine of horses and foul liquids of all kinds which are poured out upon its surface; and the granite, with its noise far exceeding the cobble, its slippery surface when worn, and its open crevices between the blocks, permitting liquids of all kinds to pass down and pollute the street surface beneath, are each and all of them subject to adverse criticism."

The least unsanitary of all pavement must be impenetrable, present a surface easily cleaned and be kept as free as possible from dust and dirt. The important questions of expense, durability and economy of repair, are the determining factors in the selection of pavement material. In streets subject to the heaviest of teaming, where the weight of the constantly passing load, the minimum resistance offered to traction are important desiderata, it is necessary not alone to have a firm foundation, but also of the first importance to have a surface highly resistant to wear. For this purpose, granite blocks are in much favor. But they should be put down by the pouring of hot asphalt or some of the tarry products, filling the interstices. In this way we have an unyielding, comparatively even-wearing surface, giving a good foothold for the horses' feet, and at the same time easily cleaned and impenetrable to fluids. Although noisy and expensive, it is perhaps the best adapted for service in this class of streets.

In the residence portions of a city, such pavement is undesirable, and at present some form of macadam is more commonly used. In the form of macadam, with or without the Telford foundation of large stones, crushed rock has been used as a road covering in Europe and America for nearly a century. Macadamized surfaces become more or less rapidly worn; the wearing is produced by the pulverization of its surface, which, when dry, is a dust more or less mingled with vegetable and animal matter. When wet, it is mud. This surface is costly to keep in repair

and is cleaned with much difficulty. In fact, it can never be freed entirely from objectionable material.

Asphalt, on the contrary, forms an impenetrable surface, is easily cleaned and can be kept clean at small cost. It is comparatively noiseless, is durable and can be easily repaired. Its first cost is greater than macadam.

From a paper published the present year by the Renssellaer Society of Engineers of Troy, N. Y., for the use of professors and students of the Institute, by J. M. Howard, upon "Natural Asphalt and Its Compounds," I quote: "The civilization of cities can be gauged by the condition of their streets. The suppression of noise and dirt, made possible by asphalt pavements, in a great measure determines the character and progress of a city. . . . Jan. 1, 1894, the total asphalt street pavements of European cities are as follows: London, twenty-four miles; Paris, twenty-six miles; Berlin, eighty three miles.

"In the United States and Canada, Trinidad asphalt, 911 miles; asphaltic limestone and other asphaltic materials, 51 miles. The volume of this industry is measured by the fact that the one branch, asphaltic paving, is found in more than ninety-one American and fifty-five European cities. This means an investment of at least fifty-five millions of municipal funds and a working capital, if combined, of \$15,000,000."

A publication upon asphaltum in 1893, from the United States Department of the Interior, by Richardson and Parker, under the head of the durability of asphalt pavements, gives the following: "With the best materials, combined and laid with the greatest skill, where traffic is of the ordinary character, and the street not too narrow, so as to confine the wheels to ruts, the life of the pavement should be fifteen years. There are surfaces in existence to-day which are of that age, which have had scarcely any repairs and seem to be good for many years to

come. Such a pavement can be seen in front of the Arlington Hotel on Vermont Avenue, Washington."

Washington is to-day known as the best paved city in America. Its seventy miles of smooth, durable asphalt afford roads which for comfort, convenience and economy of transit are unequalled.

Asphalt offers a smooth and uniform surface, which reduces the force of the traction and thereby effects an economy in transportation, and at the same time adds to the comfort of every person who rides in a carriage; in its cleanliness, containing no joints to collect street filth and give it off in dust, and no vegetable matter to decay and poison the air with noxious germs; in its noiselessness, which relieves the racket and roar of great cities, so trying to the nerves.

These excellent qualities are not denied by any one. Two defects have been alleged against it: 1, that it is slippery; 2, that it is not durable. Neither allegation is founded in fact. Careful observations by competent engineers have established the fact that under ordinary conditions of weather the number of accidents to horses from falling is greater on stone than on asphalt pavements.

The great cause of horses slipping on asphalt pavement is the foreign material which may be allowed to remain on it. For example, the slipping of the pedestrian who inadvertently steps upon a banana peel left upon the sidewalk.

When in Paris in 1890, I examined carefully a piece of roadbed on one of the public thoroughfares, laid in 1812, probably the oldest asphalt pavement in existence. The surface was even, without cracks. When put down, it was eight inches thick, and the constant service of nearly eighty years was said to have reduced its thickness less than one inch.

In Hamburg, I was shown an excellent piece of asphalt pavement, which was put down in 1840. I might refer to our own experiences in Boston, but they have not been as satisfactory. The asphalt first

laid here was defective, improper material being used. The trouble is in the asphalt sheet being quite too thin. The more recent paving with the asphalt has been much better constructed.

The repairs to such a pavement are really quite difficult to make. "If the day is cold when they are undertaken, the old surface is in a contracted condition, while the new material put in, being in a heated condition is considerably expanded. If the patch is left perfectly level with the surrounding pavement when finished, it soon settles and forms a little depression. In hot summer weather the expansion of the surrounding pavement has a tendency to push this patch on every side and make it rise above the surface surrounding it, causing a ridge. In making these patches it is customary to cut through the asphalt coating with heavy chisels, so that the part to be repaired can be removed. Then the hot mixture of asphalt and other materials is rammed into the place and tamped and rubbed with hot iron implements until it is apparently united with the old coating around it and the foundation below. It requires considerable skill and experience to do this well, and even the best men fail at times. Recently a special machine has been designed to facilitate and improve such repairs, which has been highly recommended in several cities where it is used. It consists of a sheet metal tank containing gasoline and mounted on a pair of wheels so that it can be easily moved from place to place. Behind the tank is a collection of burners so arranged that when the vaporized gasoline is forced through them by means of a small air-pump attached to the tank, the several jets of flame warm up the surface of the asphalt below them. The material becomes as soft as when first laid, and while in this condition enough of it is taken off from the injured portions by a hoe to secure a clean fresh surface. On this, fresh asphalt is rammed and rolled to the desired surface, and as the old and new material is at about the same tempera-

ture when the tamping begins, it has been found possible to weld the whole together into a homogeneous mass. Another advantage of this method of repairs is that asphalt is removed from half an inch to an inch in thickness so that not only is less new material used, but the thin coating is more easily rolled and tamped and less likely to contract and leave a depression."

The present month Hon. E. P. North, in charge of the street paving of New York city, presented his report for the paving to be accomplished the ensuing year. It includes 109,025 square yards, at an estimated cost of \$780,100. Coming from such an authority and as the result of long study and observation, I have thought it advisable to quote from the report quite freely:

"This proposal is in conformity with your general instructions to expend the public money for the greatest public good by providing asphalt pavements in the poorer and more densely populated portions of the city and on streets that are likely to become great thoroughfares. The larger sum is expended for asphalt pavements, instead of granite and trap pavements, and the money is expended either in the service of the poorer portion of the community, or in the service of all by increasing the facilities for communication between all parts of the city.

"Somewhat over 63 per cent. of the pavements re-laid since and including 1889 have been granite or trap pavements, and rather less than 37 per cent. asphalt. Of the 1,196,079 square yards of asphalt pavement now laid in this city, between 60 and 70 per cent. has been laid in the area bounded by Fourth Street on the south, Third Avenue on the east, on the west by Seventh Avenue to Fifty-ninth Street, and thence north along the Hudson River. These boundaries, somewhat roughly, include the habitations of the wealthier portions of our population.

"Most of the asphalt in this region has been laid in short lengths, which do not average, in the cross

streets, a block and a half long, there being over sixty separate pieces a full block or less in length. Some of these are without connection with other asphalted streets, so that much of the work done in this area has been a matter of luxury and convenience to those living on such streets, and is not calculated to appreciably affect either the death rate or the general health of the city, and its utility where it can not be incorporated in a general scheme is practically confined to the immediate vicinity in which it is laid.

"In the project now submitted, the only region favored is that occupied by our wage earning population, and aside from this, nothing has been incorporated that does not serve large areas and all classes of people. The principle has been to continue the very necessary work, in a sanitary point of view, commenced under our predecessor, mainly through the efforts of your consulting engineer, Mr. Towle, of asphaltting the streets in the overcrowded districts east of the Bowery, to which is added the populous regions about the Five Points. In addition to this, streets have been selected for asphalt pavement that will extend the present lines of transportation and open routes across the city which will cheapen the delivery of goods and give comfortable access to some of the more important ferries.

"Two and four-tenths per cent. of the proposed work is south of Chambers Street, in the business part of the city; 40.6 per cent. is in regions east of Centre Street and south of First Street, and 57 per cent. is devoted to routes of distribution. Of this only 22.3 per cent. is in that division of the city which contains between 60 and 70 per cent. of the asphalt now laid. So that in fact 77.7 per cent. of the proposed new work will be where most needed for sanitary purposes, in the lower parts of the city.

"It seems that as a financial measure there is sound economy in replacing our wornout pavements with asphalt. It is, however, as a sanitary appliance that an asphalt pavement presents the greatest value. It

is nearly a non-absorbent, is free from cracks that offer lurking places for disease germs, and can be thoroughly washed whenever it is thought advisable.

"Leaving the streets that swarm with the children of our poorest population paved with rough stones, the interstices between which are filled with disease-breeding filth, while the streets bordering on Fifth Avenue are paved with asphalt, does not make for the greatest good to the greatest number, and in case of a serious epidemic the practice imperils the health of the entire city."

The attention of the public is being drawn more at present to the proper construction of roadbeds than perhaps ever before. Previous to the development of the railroad system in the United States, however, it is interesting to note the engrossing attention which former generations gave to the improvement of internal intercommunication throughout the older States. It was well understood by them that good roads are desirable on the highest economic grounds, not to speak of their value when judged from the esthetic point of view. The revival of this spirit has been especially noteworthy in Massachusetts during the last few years, largely brought about by one of her indefatigable public-spirited citizens, Col. Albert A. Pope, seconded by his cohorts of bicyclists.

Massachusetts has a State Highway Commission, appointed for the supervision of the construction of new, and rebuilding of old roads. Her appropriation of last year was expended in making short pieces of thoroughly good country roads, in selected parts of the State, in large measure as object lessons for instruction. This year her Legislature appropriates \$300,000 for the further prosecution of this popular work.

The attention of scientists all over the world has been directed anew to the development of improved methods of road building, and Congress has recently made an appropriation for the investigation of this

subject, in order that information upon the best methods of road making may be widely discussed and disseminated.

Laboratory work is being carried on at Harvard University upon the value of the different kinds of stones best adapted to road building.

In Massachusetts, the towns are taking up the subject and the dissemination of the good work in this important branch of internal improvements is thus permeating the entire State. This work is not limited to Massachusetts, since a number of the States have already passed new road laws, and the subject is being popularly discussed throughout the entire country. Especially in urban life is the sanitation of the street of the greatest importance, and it seems to me most fitting that the scientific men of the country should exercise a molding influence upon the development of this great public improvement. I have therefore deemed it fitting to ask the attention of the members of the Section in State Medicine of the AMERICAN MEDICAL ASSOCIATION to this subject and to give it due discussion and deliberation.

The subjoined letters are of interest and value. They represent purposely, several of our larger cities in widely varying latitudes with marked variations of climate:

CHIEF SANITARY INSPECTOR'S OFFICE,
ATLANTA, GA., July 23, 1894.

HENRY O. MARCY, M.D.—*Dear Sir:*—Your letter of July 20 to hand, and in reply will state that I consider the "asphalt paving" the prettiest paving for your avenues in Boston; it is easily kept clean, is noiseless, and would give entire satisfaction. Any further information I will gladly furnish.

Very respectfully, THOS. E. VEAL, Chief Inspector.

CITY SURVEYOR'S OFFICE,
MONTREAL, CAN., July 23, 1894.

HENRY O. MARCY, M.D.—*Dear Sir:*—I am in receipt of your letter of July 20, asking me for my opinion as to the best pavement to be used for a residential street with light traffic thereon. I would certainly recommend Trinidad asphalt. We have had Trinidad asphalt laid by the Warren Scharff

Co., of New York, and it has stood this climate for seven years with heavy traffic.

Yours truly,
P. W. ST. GEORGE, City Surveyor.

OFFICE OF CITY ENGINEER,
SAVANNAH, GA., July 23, 1894.

HENRY O. MARCY, M.D.—*Dear Sir:*—Your note of July 20 came to hand and contents noted. The city of Savannah has a great many streets paved with asphalt. and it gives entire satisfaction. The Warren Scharff Paving Co. has done most of our work. It stands heavy traffic as well as light.

I am yours respectfully,

JOHN FITZGERALD, Sup't Streets.

DEPARTMENT OF PUBLIC WORKS,
CHICAGO, July 23, 1894.

HENRY O. MARCY, M.D.—*Dear Sir:*—Your favor of July 20, relative to asphalt pavement received. We have 16.65 miles of sheet asphalt streets in this city. This class of improvement when well laid has given general satisfaction on resident streets in this city. Dearborn Avenue, which was improved with asphalt eleven years ago, has just been repaired at an expense to the city of \$570. It is now in as perfect condition as it was when originally completed.

Yours very truly,

JOHN MCCARTHY,
Superintendent of Streets.

DEPARTMENT OF PUBLIC WORKS, COMMISSIONER'S OFFICE,
No. 31 CHAMBERS STREET, NEW YORK, July 24, 1894.

HENRY O. MARCY, M.D.—*Dear Sir:*—In answer to your inquiry of July 20, regarding experience in this city with asphalt pavements, I beg to say that the experience of the last six years has shown good asphalt to be the very best pavement for residential streets and on streets used for pleasure driving, provided the grades are not too steep; that is, not to exceed 4 in 100. It has many advantages over macadam or stone, in being noiseless, impervious to liquid filth, easy to keep clean, and about one-fourth less expensive to maintain. We have now in this city fifty-five miles of asphalt pavement, nearly all in private residential and tenement-house districts.

Very respectfully,

MICHAEL T. DALY,
Commissioner of Public Works.

STREET DEPARTMENT, STREET COMMISSIONER'S OFFICE,
ST. LOUIS, Mo., July 24, 1894.

HENRY O. MARCY, M.D.—*Dear Sir:*—Answering your favor of July 20, would say that we have a little over nine miles of

asphaltum streets in St. Louis, and they are giving entire satisfaction to the tax-payers. We have not confined the use of asphaltum streets to light traffic alone, as we have roadways here paved with that material over which from 5,000 to 7,000 vehicles pass daily with loads of from 1,000 to 10,000 pounds. Personally and officially I am in favor of asphalt for paving all classes of streets.

Very respectfully,

M. J. MURPHY,
Street Commissioner.

